

WHAT IS CLAIMED IS:

1. A shift mechanism for an outboard motor mounted on a stern of a boat and having an internal combustion engine at its upper portion and a propeller at its lower portion that is powered by the engine to propel the boat, comprising:

5 a propeller shaft connected to the propeller;

a forward gear and a reverse gear rotating the propeller shaft in a forward direction or in a reverse direction opposite to the forward direction, when engaged with the propeller shaft in response to a rotation of a shift rod;

10 a vertical shaft connected to the engine and transmitting an output of the engine to the propeller shaft through the forward gear or the reverse gear when the forward gear or the reverse gear is engaged to the propeller shaft; the vertical shaft being divided into a plurality of shaft members;

an electromagnetic clutch connecting/disconnecting the shaft members of the vertical shaft;

15 a sensor generating a signal indicative of an instruction to shift inputted by an operator; and

a controller controlling the operation of the electromagnetic clutch in response to the instruction to shift such that one of the forward gear and the reverse gear corresponding to the instruction to shift is engaged with the propeller shaft.

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2. The shift mechanism according to claim 1, wherein the controller controls to operate the electromagnetic clutch to disconnect the vertical shaft members until the one of the forward gear and the reverse gear has been engaged with the propeller shaft,  
25 and then controls to operate the electromagnetic clutch to connect the vertical shaft members after the one of the forward gear and the reverse gear has been engaged with the propeller shaft.

3. The shift mechanism according to claim 2, further including;  
a synchromesh mechanism having a sleeve to be meshed with the forward gear or the reverse gear; and  
an actuator to rotate the shift rod;  
5 and wherein the controller controls to operate the actuator such that the sleeve meshes with the one of the forward gear and the reverse gear.

4. The shift mechanism according to claim 3, wherein the shift rod having a  
10 rod pin that is displaced in response to the rotation of the shift rod such that the sleeve meshes with the one of the forward gear and the reverse gear.

5. A shift mechanism for an outboard motor mounted on a stern of a boat and  
15 having an internal combustion engine at its upper portion and a propeller at its lower portion that is powered by the engine to propel the boat, comprising:

a propeller shaft connected to the engine and the propeller;  
a forward gear and a reverse gear rotating the propeller shaft in a forward direction or in a reverse direction opposite to the forward direction, when engaged with  
20 the propeller shaft;

a first electromagnetic clutch engaging the forward gear with the propeller shaft;

a second electromagnetic clutch engaging the reverse gear with the propeller shaft;

25 a sensor generating a signal indicative of an instruction to shift inputted by an operator; and

a controller controlling to operate the first and second electromagnetic clutches in response to the instruction to shift such that one of the forward gear and the

reverse gear corresponding to the instruction to shift is engaged with the propeller shaft.

5           6. The shift mechanism according to claim 5, wherein the forward gear and the reverse gear are disposed around the propeller shaft and are being bored to have central holes in such a manner that clutch sections of the first and second electromagnetic clutches are each installed in a space made between an inner surface of the hole and an outer surface of the propeller shaft.

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7. The shift mechanism according to claim 6, wherein each of the clutch sections of the first and second electromagnetic clutches including:

a cam ring fastened to the outer surface of the propeller shaft; and

15           a plurality of rollers rotatably disposed in a space between the cam ring and the inner surface of the hole;

and one of the first and second electromagnetic clutches associated with the one of the forward gear and the reverse gear corresponding to the instruction to shift, when operated, transmitting a rotation of the inner surface of the hole to the cam ring  
20 by engaging the cam ring with the inner surface of the hole.

8. The shift mechanism according to claim 7, wherein the one of the first and second electromagnetic clutches gradually transmits the rotation of the inner surface of  
25 the hole to the cam ring until the cam ring has been engaged with the inner surface of the hole after operated at a beginning of shift.